

her natural position on the floor of the nest, and the male, proceeding in his turn to the ceiling, fecundates the eggs which she has fixed there. This manœuvre is repeated during an hour or two until all the ripe eggs have been expelled*.

When the process of laying is completed the female abandons the nuptial domicile, never to return; but the male remains and watches over the eggs until the young are hatched; for the small Crustacea which abound on the sandy shores, and on which *Gobius minutus* subsists (*Crangon*, *Mysis*), would eat the eggs were they not vigilantly guarded by him.

During the time that the development of the young is proceeding the male vibrates his tail and pectorals, so as to set up currents under the shell, which ensure the renewal of the water in it.

If after a male has made choice of a domicile under a shell we turn the concavity upwards, he restores it to its original position in the following manner:—

He begins by passing under the edge of the shell, rakes up the sand about it if necessary, then placing himself at the side opposite to the hinge, he nips one of the sides gently, and by a rapid movement of his tail describes a semicircle in the surrounding water in such manner as to swing round the shell till its concavity is underneath. Then he clears this at some point in its contour, and introduces himself beneath; he then throws out the superfluous sand in the interior and covers it as has been described above. When the male is guarding the clutch that he has fecundated the experiment is still more certain of success.

If we drive away a male from the nest he has prepared he is not long in returning to it, even if other shells resembling his own are placed near his dwelling for the purpose of deceiving him. If when a male is watching over the eggs which he has fecundated we drive him away and replace his shell by another, leaving the first at a little distance, when he returns he enters the shell which occupies the position the first had without hesitation; but he is not long in perceiving that it does not contain his eggs; then he quits it to seek for and retake possession of the first. He does not scruple to fight furiously if during the experiment another male has possessed himself of the shell containing his offspring.—*Comptes Rendus*, Aug. 10, 1891, p. 293.

On the Excretory Apparatus of the Carididæ, and on the Renal Secretion of the Crustacea †. By M. P. MARCHAL.

I. In a previous note I briefly described the excretory apparatus of *Palæmon*. I have since examined a few other Carididæ, which exhibit, in this respect, certain important differences. In *Nika edulis* the labyrinth is wanting; the gland is formed solely by the

* To make the observations respecting the laying, instead of supplying shells to the males I gave them watch-glasses, which I covered or uncovered at will by means of a brush.

† The investigations were carried out at the Arago laboratory (Banyuls-sur-Mer).

saccule, which opens directly into the vesical system *. The vesical system is constructed approximately upon the same plan as in *Crangon* †; there is no unpaired sub-stomachal bladder, but two sub-stomachal lobes, much closer together than in *Crangon*; this approximation appears to mark a transition towards the unpaired sub-stomachal bladder of *Palaemon*. There is a wide communication between the two vesical systems by means of a broad commissure, situated in front of the stomach, and prolonged beneath this organ by means of a median and unpaired mass which plunges into the labrum; we find a rich vesical collar surrounding the œsophagus.

Alpheus (*A. ruber*) exhibits a vesical system resembling that of the Crangonids. We meet with two sac-shaped lobes, descending along the sides of the stomach: on each side of the œsophagus there is detached a long narrow lobe, which extends as far as the base of the first pair of limbs.

In *Caridina Desmarestii*, a fresh-water type, the gland presents a saccule and a labyrinth. As in *Palaemon*, the saccule forms a little rounded mass, distinct from the labyrinth, partitioned in its interior, and projecting into the interior of the bladder; it communicates with the lacunæ of the labyrinth by means of a kind of atrium. The gland is capped on its inner face by a sac which represents the bladder: the latter is of small size, and presents the peculiarity of being continuous with a broad canal of which it is only the expansion: this canal winds somewhat, and opens, narrowing at the same time, at the level of the excretory tubercle.

II. The production of the urinary liquid in Crustacea is not due to a simple filtration, as the limpidity and abundance of the liquid which fills the bladder might lead us to believe; there is a real secretion, with separation of the cellular portions. In the liquid excreted by *Maia*, we find perfectly round and refringent globules of variable size; the same is the case for the Crayfish, the Spiny Lobster, &c.

In the *Paguri*, the clear liquid which inflates the abdominal bladder contains vesicles, which are more or less granular, often of large size, and may enclose a larger or smaller number of secondary vesicles. When the animal has been injected with indigo-carminé, we find blue granulations in these vesicles.

If we examine the bladder in the urine or the blood of the animal, we find that the cells are swollen so as to form domes, or large transparent vesicles, often enclosing secondary vesicles. On being set at liberty, they constitute the vesicles which we find in the excreted liquid; when they are free, their membrane has a very low degree of resistance: one drop of picro-carminé is enough to cause them to disappear in a few moments.

I have found the same swollen vesiculated cells in the bladder of the most varied types: it is evident that the bladder takes an important part in the secretion.

* Weldon has just determined the same fact in *Crangon*, and my independent researches on the same animal have confirmed this result.

† I described the bladder of *Crangon* in a previous note ('Comptes Rendus,' October 20, 1890).

The white substance of the Crayfish secretes in a manner analogous to that of the bladder; its cells are similarly swollen at their extremity into large clear vesicles, distinct from the body of the cell. As regards the cortical substance of the Crayfish, and the labyrinth of the other Crustacea, several vesicles exist at once in the same cell: they are, in general, tolerably numerous, oblong, and ranged regularly side by side: they then present the appearance of a sort of palisade, covering the cells, and the elements of which correspond pretty exactly to the striation of the bodies of the cells. The saccule equally secretes, by separating cellular portions, which are expelled in the shape of vesicles frequently coloured yellow.—*Comptes Rendus*, tome cxiii. no. 4 (July 27, 1891), pp. 223-225.

*On the Circulatory and Respiratory Apparatus of certain
Arthropods.* By M. A. SCHNEIDER.

AMPHIPODS.—I have injected *Talitrus*, the ordinary fresh-water Shrimp, and *Niphargus*. In all I found that the heart emits three pairs of lateral arteries, of which the first two arise immediately below the second and third pairs of cardiac ostia, while the third is given off pretty nearly in the middle of the space which separates the third pair of cardiac ostia from the origin of the posterior aorta. These lateral arteries give rise to numerous ramifications, which principally pass to the biliary apparatus.

Claus described lateral arteries in the *Hyperina*: to-day we are able to affirm that they exist in the whole group.

ARACHNIDA. *Scorpion*.—The vessels formerly described by Newport and Blanchard in the Scorpion have more recently been regarded as simple lacunæ. Their primitive value must, however, be retained for them.

Sections of these vessels, in particular of the spinal artery, show a distinct wall, with striated muscular fibres, which are absent, on the contrary, in the neurilemma; successful injections never show extravasations, and those which contain nitrate of silver everywhere disclose a splendid endothelium. The same results are obtained in the Araneida.

The vascular topography, as determined by my predecessors, is correct in its ensemble; but many new details have presented themselves to me, into a detailed description of which I shall not enter, but confine myself to mentioning:—(1) Five transverse anastomoses between the two halves of the annular vessel, each giving off a *sternal* artery, which plunges into the sub-œsophageal mass; (2) four other sternal arteries, which arise below the initial portion of the spinal artery, and of which the posterior becomes the artery of the pectines; (3) anastomoses in the caudal region, or post-abdomen, not such as Newport described, but between the two branches formed by the bifurcation of the sternal arteries of this region and the posterior aorta.

ARANEIDA.—I have studied the lung of Spiders and am absolutely convinced that the chitinous envelope, recently described as